

**WHAT IS CLAIMED IS:**

1           1. A differential interferometric confocal microscope for measuring an object,  
2 said microscope comprising:  
3           a source-side pinhole array;  
4           a detector-side pinhole array; and  
5           an interferometer that images the array of pinholes of the source-side pinhole  
6 array onto a first array of spots located in front of an object plane located near where the  
7 object is positioned and onto a second array of spots behind the object plane, wherein the  
8 first and second arrays of spots are displaced relative to each other in a direction that is  
9 normal to the object plane, said interferometer also (1) imaging the first arrays of spots  
10 onto a first image plane that is behind the detector-side pinhole array, (2) imaging the  
11 first array of spots onto a second image plane, (3) imaging the second array of spots onto  
12 the second image plane, and (4) imaging the second array of spots onto a third image  
13 plane that is in front of the plane defined by the detector-side pinhole array,  
14           wherein each spot of the imaged first array of spots in the first image plane is  
15 aligned with a corresponding different spot of the imaged second array of spots in the  
16 second image plane and a corresponding different pinhole of the detector-side pinhole  
17 array, and  
18           wherein each spot of the imaged first array of spots in the second image plane  
19 coincides with a corresponding different spot of the imaged second array of spots in the  
20 second image plane and is aligned with a corresponding different pinhole of the detector-  
21 side pinhole array.

1           2. A differential interferometric confocal microscope for measuring an object,  
2 said microscope comprising:  
3           a source-side pinhole array for producing an array of input beams; and  
4           a detector-side pinhole array; and  
5           an interferometer including:  
6           a first optical element providing a first reflecting surface;  
7           a second optical element providing a second reflecting surface; and

8 a beam splitter positioned between the first and second optical elements,  
9 wherein the beam splitter produces from the array of input beams a first array of  
10 measurement beams and a second array of measurement beams,  
11 wherein the first reflecting surface participates in focusing the first array of  
12 measurement beams onto a first array of locations on a first object plane in object space  
13 and the second reflecting surface participates in focusing the second array of  
14 measurement beams onto a second array of locations on a second object plane in object  
15 space, said first and second object planes being parallel to and displaced from each other,  
16 wherein the first array of measurement beams generates a first array of return  
17 beams from the object and the second array of measurement beams generates a second  
18 array of return beams from the object,  
19 wherein the first and second reflecting elements participate in producing from the  
20 first array of return beams (1) a first array of converging beams that converge to a first  
21 array of spots on a first image plane and (2) a second array of converging beams that  
22 converge onto a second array of spots on a second image plane,  
23 wherein the first and second reflecting elements participate in producing from the  
24 second array of return beams (1) a third array of converging beams that converge onto the  
25 second array of spots on the second image plane and (2) a fourth array of converging  
26 beams that converge onto a third array of spots on a third image plane,  
27 wherein said first and third image planes are adjacent to and on opposite sides of  
28 the detector-side pinhole array, and the second image plane lies between the first and  
29 third image planes, and  
30 wherein the detector-side pinhole array combines the first, second, third, and  
31 fourth arrays of converging beams to form an array of output beams.

1 3. The differential interferometric confocal microscope of claim 2 wherein a  
2 single pinhole array serves as both the source-side pinhole array and the detector-side  
3 pinhole array.

1 4. The differential interferometric confocal microscope of claim 3, wherein the  
2 first optical element is located between said single pinhole array and the beam splitter and

3 wherein the second optical element is located between a location at which the object is  
4 positioned during use and the beam splitter, wherein the first reflecting surface has a  
5 center of curvature for which there is a corresponding conjugate as viewed through the  
6 beam splitter, and wherein the second reflecting surface has a center of curvature that is  
7 displaced relative to the corresponding conjugate of the center of curvature of the first  
8 reflecting surface.

1 5. The differential interferometric confocal microscope of claim 4, wherein the  
2 conjugate of the center of curvature of the first reflecting surface and the center of  
3 curvature of the second reflecting surface are displaced from each other in a direction that  
4 is normal to a plane defined by the beam splitter.

1 6. The differential interferometric confocal microscope of claim 5, wherein the  
2 first reflecting surface participates in focusing the first array of measurement beams via  
3 the beam splitter onto the first array of locations and the second reflecting surface  
4 participates in focusing the second array of measurement beams via the beam splitter  
5 onto the second array of locations.

1 7. The differential interferometric confocal microscope of claim 6 wherein the  
2 first reflecting surface is substantially concentric with a point on the object.

1 8. The differential interferometric confocal microscope of claim 8, wherein the  
2 second optical element provides a refracting surface positioned between the object and  
3 the beam splitter to receive light rays from the object.

1 9. The differential interferometric confocal microscope of claim 9, wherein the  
2 first reflecting surface substantially conforms to a sphere having a first radius and the  
3 refracting surface conforms to a sphere having a second radius, wherein the first radius is  
4 greater than the second radius.

1 10. The differential interferometric confocal microscope of claim 9, wherein the  
2 first optical element provides a refracting surface positioned between the beam splitter  
3 and said single pinhole array.

1           11. The differential interferometric confocal microscope of claim 10 wherein the  
2 second reflecting surface is substantially concentric with an image point on said single  
3 pinhole array.

1           12. The differential interferometric confocal microscope of claim 11, wherein the  
2 second reflecting surface substantially conforms to a sphere having a first radius and the  
3 refracting surface conforms to a sphere having a second radius, wherein the first radius is  
4 greater than the second radius.

1           13. The differential interferometric confocal microscope of claim 6, wherein said  
2 single pinhole array is a two-dimensional array.

1           14. The differential interferometric confocal microscope of claim 13, wherein the  
2 two-dimensional array is of equally-spaced holes.

1           15. The differential interferometric confocal microscope of claim 14, wherein the  
2 equally-spaced holes are circular apertures.  
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